

1999 Conference on Unburned Carbon in Utility Fly Ash Abstract for Poster Session

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Use of High Carbon Fly Ash in the Manufacture of Cement

A project was undertaken to demonstrate the potential for use of high-carbon fly ash in the manufacture of portland cement. The goal was to develop a use for large amounts of high-carbon fly ash as a source of both energy and raw materials. The study consisted of a review of the technical literature followed by a laboratory and pilot plant study.

Numerous candidate fly ashes were analyzed to determine their chemical compositions. Based on these results, fly ashes were selected from four power plants for further testing. A companion cement plant was selected for each power plant.

Extensive testing was performed to characterize the chemical and physical properties of the fly ashes and raw materials from the cement plants. Based on the analyses, raw mix designs were developed for each cement plant. One was designed to replicate the raw materials (kiln feed) currently being used at the cement plant. Another was designed with the same composition, but incorporating the fly ash from the companion power plant. These mixes were fired in a bench-scale kiln to produce portland cement clinkers. The results of this work showed that three of the cement plant-power plant combinations warranted further work at the pilot plant scale. Two portland cement clinkers, one with and one without fly ash, were made from materials supplied by each cement plant-power plant pair.

The six clinkers thus produced were analyzed to determine their chemical composition and mineral phases. They were then ground with gypsum to make cements, which were evaluated by a series of tests to determine their overall performance. The results demonstrate the practicality of manufacturing cements that meet all of the standard requirements of ASTM C 150 for Type I portland cements. The use of fly ash as a raw material offers potential economic benefits to the cement industry in terms of significant fuel savings and reduced alkali content of the cement.